PCB CHARACTERIZATION WORK PLAN

FORMER GST STEEL FACILITY SITE
Kansas City, Missouri

Project: 148313

February 12, 2013

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1.0 INTRODUCTION

The *PCB Characterization Work Plan* (Work Plan) was prepared by Shaw Environmental, Inc. (Shaw) as an addendum to the "Notification & Certification of Self-Implementing Cleanup and Disposal of PCB Remediation Waste" dated March 31, 2012 to document the proposed polychlorinated biphenol (PCB) characterization sampling activities. A series of remedial action (RA) activities were conducted by Compass Big Blue, LLC (Compass) and documented by West Central Environmental Consultants, Inc. (WCEC). The majority of the known PCB impacted soil has been removed from the site and disposed at an approved offsite landfill. The excavations and a concrete vault were filled with onsite soil. PCB impacted soil above 25 parts per million (ppm) remain onsite east of the former substation pad, extending to the northeast. The EPA had expressed concerns that the requirements of 40 CFR 761.61 and Subpart O have not yet been satisfied for the site.

On November 26, 2012, the Environmental Protection Agency Region 7 (EPA) requested testing of the fill material placed in the previous excavation, testing of the concrete vault located beneath the substation pad, and characterization of the PCBs in the soil to 1 ppm prior to conducting any further RA activities. This Addendum was prepared to fulfill the requirements of 40 CFR 761.61 and Subpart O and the requests of the EPA. Field activities proposed in this Addendum will be conducted in accordance with the approved Work Plan, 40 CFR 761.61 and Subpart O, and the provided Shaw standard operating procedures (SOPs).

1.1 Objective

The objective of this work plan is to present the conceptual approach and outline procedures for field personnel to follow during the PCB characterization activities. The proposed investigation will be conducted to 1) confirm PCB concentrations in the vault cover, 2) confirm PCB concentrations in the material used to fill the previous excavations and vault, 3) confirm PCB concentrations in the floor of the previous excavations, 4) characterize the extent of PCB concentrations in the native soil to 1 ppm, and 5) confirm PCB concentrations in exposed concrete adjacent to impacted soil, where exposed. This information will be used to assess remaining PCB concentrations at the site and evaluate remedial options. The following tasks will be performed to meet the objectives:

- Collect two chip samples from the concrete surface of the vault to determine PCB concentrations. If PCB concentrations exceed 1 ppm, additional samples will be collected from the surface of the pad outside of the vault cover to characterize the extent of surface cotamination.
- Remove the concrete slab over the vault to provide access to the vault. Disposal will be based on the results of the surface concrete chip samples.
- Collect a composite sample of the fill material located within the vault to determine PCB concentrations.
- Collect four composite samples from the fill material placed in previous excavations to determine PCB concentrations.
- Collect composite samples of the bottom and side walls of the concrete vault to evaluate PCB concentrations. This task requires the removal of fill material from the vault after testing to determine handling and potential disposal options.

- Collect confirmation samples of the native soil located at the base of the previous excavation.
- Collect discrete soil samples along the northeast, east, and southeast limits of the previous excavations to characterize the limits of 1 ppm PCBs. Additional sample collected, if required for characterization, will be conducted on a 1.5 meter sample grid.
- Concrete, soil, and fill material samples will be submitted to an EPA certified laboratory for PCBs analysis.
- Prepare a brief report to summarize the findings and recommend a remedial option. The report will include the cumulative data from the previous sampling events, where available.

2.0 SITE SAMPLING PROCEDURES

This section presents a description of the field sampling activities and protocols to be implemented during the sampling program. The activities discussed in this section include fill material sampling, confirmation sampling, vault sampling, and characterization sampling. The locations of the proposed samples to be collected are illustrated in **Figures 1** and **2**. Sample collection depths are referenced from the top of the former substation pad as referred to as below ground surface (bgs) in this document.

All field activities will be conducted in accordance with the Shaw SOPs provided in **Appendix A**. All field activities and sampling procedures will be documented in a field logbook as outlined in SOP EI-FS001 Field Logbook. Equipment decontamination will be conducted in accordance with procedures outlined in SOP EI-FS014 Decontamination of Contact Sampling Equipment.

2.1 Field Activities

Field activities will be conducted in three phases. Phase 1 will be to chatracterize PCB concentrations in the concrete vault cover. Phase 2 remove the vault cover and verify the PCB concentrations in the fill material. Phase 3 characterize the extent of PCBs in the soil and concrete to 1 ppm.

Phase 1, chip samples will be collected at two locations on the surface of the vault cover to evaluate PBC concentrations in the concrete. If PCBs are detected in the concrete, additional chip samples will be collected on 1 .5 meter grid to characterize the extent of the PCBs in the surface concrete. The vault cover will not be removed until the concrete cover is characterized.

Phase 2, the fill material will be analyzed to verify the PCB concentrations. The vault cover will be removed to provide access for sample collection. Debris from the vault cover will be managed based on Phase 1 analytical data. Composite soil samples will be collected from the four identified areas as illustrated in **Figure 1**. This information will be used to determine how to manage the fill material and approach the Phase 3 characterization. This activity will result in disturbance to the pad and minimal disturbance to the site.

Phase 3, discrete soil samples will be collected from the former excavations, adjacent soil, and exposed concrete structures to characterize PCB's to 1 ppm. Borings will be advanced through the fill material, where necessary, to characterize PCBs in the underlying soils. Fill material will be removed from the vault to access the vault. Samples will be collected from the vault to characterize potential residual PCBs in the concrete. Fill material removed from the vault and debris from the vault cover will be managed accordingly based on Phase 1 and 2 test results.

2.1.1 Fill Material Samples

A series of removal actions were conducted at the site to remediate PCB impacted soil at concentrations exceeding 1 ppm. Fill material consisting of onsite soil was used to fill in the excavation pits following the last removal action. The fill material was reportedly placed over four layers of heavy plastic sheeting (thickness not specified) to prevent potential cross-contamination of the fill material by the underlying soil. No analytical data was provided to document the PCB concentrations in the fill material.

Four excavations were identified based on the relative location to the concrete pad and excavation depth. The excavation in the northeast portion of the concrete pad was approximately 17 feet long by 15 feet wide and averaged 5.5 feet deep (northeast pad excavation). The adjacent excavation to the east was approximately 9 feet long by 17 feet wide and averaged 10 feet deep (east excavation). The excavation to the north was approximately 5 feet long by 15 feet wide and averaged 3.5 feet deep (north excavation). The excavation to the southeast was approximately 4 feet long by 10 feet wide and averaged 4 feet deep (southeast excavation).

In Phase 2, four composite samples will be collected from the fill material located within the limits of the excavations. Once the vault cover has been removed, one composite sample will be collected from the fill material located in the vault. Each composite sample will consist of ten aliquots. The aliquots will be collected at five locations within the limits of the designated excavation, two intervals per location. The sample intervals will be based on the thickness of fill material placed in each excavation to provide sample aliquots representative of the fill material. The lower sample interval will terminate a minimum of 1 foot above the perceived bottom of the excavation to reduce the risk of puncturing the plastic sheet placed at the bottom of the excavations, potentially cross contaminating the fill material. Aliquots will be collected from three and two boring locations in the north and southeast excavations, respectively, due to the relatively small quantity of fill material within these excavations. The sample intervals for each excavation are as follows:

- Northeast Pad Excavation: five locations, 1 to 2 feet and 3.5 to 4.5 feet bgs
- East Excavation: five location, 1 to 2 feet and 7 to 8 feet bgs
- North Excavation: three locations, 0 to 1 feet and 1.5 to 2.5 feet bgs
- Southeast Excavation: two locations, 0 to 1 feet and 1.5 to 2.5 feet bgs
- Vault: four locations, 1 to 2 feet and 3 to 4 feet bgs

Composite sample will be collected at locations illustrated in **Figure 1**. Fill material samples will be collected following procedures outlined in SOP EI-FS100 (Hand Auger Sampling) provided in **Appendix A**. Sampling activities will be documented in the field logbook and appropriate forms. This will include documentation of the location, sample ID, sample date and time, site conditions, and sample procedures.

2.1.2 Confirmation Samples

Data gaps were identified in the number and location of confirmation samples following the previous RAs. In Phase 2, discrete soil samples will be collected at the bottom of the previous excavation to confirm the PCB concentrations of the soil left in place. It is our understanding that plastic sheeting was placed over the excavation prior to placement of fill material to provide a protective barrier between the underlying soil and fill material. A dual tube sampler (DT Sampler) will be used during sample collected to minimize the potential for cross contamination. The number and location of the proposed discrete soil samples for confirmation purposes are illustrated in **Figure 2**.

A DT sampler with 3.25-inch rods or equivalent will be advanced to approximately 1 foot from the base of the fill material in the respective excavation. A soil sampler will be advanced through the DT rods to collect continuous soil samples from the base of the fill material to the terminal target depth. The sampler will be equipped with a clear PVC liner providing a 1.85-inch diameter soil core. This sample procedure will provide physical separation between the fill material and the soil sampler while providing adequate sample volume throughout the target interval for analytical testing.

Two soil samples will be collected at each proposed confirmation sample location illustrated in **Figure 2**. One sample will be collected from the 2-foot interval directly below the bottom of the excavation. The second sample will be collected from the interval 4 to 6 feet below the bottom of the excavation. The actual sample interval as referenced from the ground surface will vary with the respective excavation. Each sample collected from the target 2-foot sample interval designated for laboratory testing will be placed in a new 1-gallon ziplock bag and homogenized following SOP EI-FS010 (Sample Homogenization).

2.1.3 Vault Samples

A vault is located near the center of the former substation pad with an access hole approximately 30-inches in diameter. A water sample collected on September 27, 2012 from the vault contained 30.8 ug/L PCBs. Fluid from the vault was removed and the vault was subsequently filled with soil obtain from the site. Confirmation samples are required from the fill material located in the vault and bottom and side walls of the vault itself. This will require the demolition of the concrete pad over the vault to access the fill material.

In Phase 1, chip samples will be collected at two locations on the vault cover. The chips samples will be collected following procedures outlined in SOP EI-FS122 (Chip Sampling). An electric hammer drill is proposed for the collection of the chip samples. If PCB concentrations in the chip samples exceed 1 ppm, additional chip samples will be collected from the concrete pad on the established 1.5 meter grid to characterize the extent of PCBs in the concrete surface. The vault cover will not be removed during this phase pending analytical results.

In Phase 2, the portion of the concrete pad located over the vault will be removed to provide access to the vault. Debris generated during this activity will be managed based on the Phase 1 analytical results. If PCB concentrations exceed 1 ppm, the debris will be placed in a roll off box lined with 6 mil plastic sheeting pending offsite disposal.

One composite sample will be collected from the fill material located within the vault and tested for PCBs. The composite sample will contain eight aliquots collected from four boring locations, two sample intervals per boring as described in Section 2.1.1 of this document. The samples will be collected adjacent to each on the vault walls.

In Phase 3, the fill material will be removed from the vault and managed accordingly based on the PCB concentrations detected during laboratory testing. Concrete chip samples will be collected from the bottom and below the water line on opposing side walls of the vault once the fill material has been removed. The chips samples will be collected following procedures outlined in SOP EI-FS122 (Chip Sampling). An electric hammer drill is proposed for the collection of the chip samples.

2.1.4 Characterization Samples

Additional characterization is required to delineate PCB concentrations in the soil to 1 ppm. Additional sampling is required on the northeast and southeast extents of the previous removal action excavations. The most recent known data was collected on November 5, 2012. This data indicated that PCB concentrations in excess of 25 ppm remain in the soil below the limit of excavation and extends to the northeast of the East Excavation and greater than 1 ppm below the limit of excavation in the Southeast Excavation.

Continuous soil samples will be collected on a 1.5 meter grid around the perimeter of the East Excavation using a 4-foot macro sampler or equivalent equipped with a disposable

PVC sleeve. Discrete soil samples for laboratory analysis will be collect from the continuous core samples at roughly 4 foot intervals extending from 2 feet bgs to a depth below the perceived contamination. The terminal sample depth varies between locations based on historic data. Samples collected from intervals with perceived contamination outside of the limits of excavation will be analyzed first. The laboratory will be directed to hold the remaining samples pending the analytical results from the initial samples. If PCB concentrations are detected above 1 ppm, a subsequent sample will be analyzed. The proposed sample locations are illustrated in **Figure 2**. The number and individual sample intervals are summarized in **Table 1**. Characterization samples will be collected following procedures outlined in SOP EI-GS021 (Direct Push Drilling and Sampling) provided in **Appendix A**.

Additional samples collection may be required to characterize PCB concentrations to less than 1 ppm in the soil. If required, additional sample collection will follow the established 1.5 meter grid.

2.2 Decontamination

All equipment that has the potential to come into contact with the sample media will be decontaminated prior to and following use. This includes, but is not limited to, hand auger, discrete samplers (Geoprobe®), mixing bowls, etc. In general, decontamination will follow procedures outlined in SOP EI-FS014 (Decontamination of Sampling Equipment).

Decontamination of dual tube and macro samplers, sample rods, hand auger, and small sampling equipment will be conducted using new 5-gallon buckets or equivalent to contain decontamination fluids. Equipment will be cleaned using an Alconox/water solution, then rinsed with deionized (DI) water prior to and following use.

Demolition equipment, which may include a mini excavator and skid loader with breaker will be decontaminated by the contractor. All sampling equipment that comes in contact with potentially impacted soil will require decontamination prior to and following use. The equipment will be placed on plastic sheets and all visible soil and debris removed by dry-scrapping the parts that came in contact with the soil. This process will be followed by hand cleaning using an Alconox/water solution, then rinsing with deionized (DI) water. Decontamination fluids will be contained by the contractor and transferred into 55-gallon drums for testing and disposal. Plastic sheets and other non-liquid IDW will be placed in a 55-gallon drum labeled IDW for disposal. The location of the decontamination area is illustrated in Figure 3.

Decontamination fluids will be changed frequently based on visual observation. Waste decontamination fluids will be placed in an appropriately labeled 55-gallon drum for temporary storage. A sample will be collected from the waste decontamination fluid and analyzed for PCBs using EPA SW-846 Method 8082 to determine disposal options.

2.3 Analytical Program

Analytical requirements for the fill material, concrete chip, and characterization samples were determined to evaluate remedial options. Per the acknowledgement of the EPA Region 7, subsurface concrete structures will be managed as soil for remedial purposes. Historic analytical data is provided in **Appendix C**.

Soil and concrete chip samples will be submitted to the laboratory for PCB analyses following EPA SW-846 Method 8082 on a standard turnaround time. Aroclor 1260 was the

only PCB historically detected at the site. This method has a method detection limit of 1.8 ug/Kg for Aroclor 1260. Sample collection and handling will be conducted under standard chain-of-custody. The samples will be delivered to the laboratory by a Shaw representative or picked up by a representative from the laboratory.

Sample documentation, chain of custody, and shipping and packing procedures are outlined in SOP EI-FS006 Sample Label, SOP EI-FS003 Chain of Custody Documentation, and SOP EI-FS012 Shipping and Packing of Non-Hazardous Samples, respectively.

2.4 Exclusion Zone

The site is located in the east extent of Tract F-7 of the former GST Steel facility. The site is bordered by railroad tracks on the north, east, and south site with heavy vegetation along the tracks which restricts access to the site.

An exclusion zone will be established on the west boundary of the site to restrict access to the site from the west. The security fence will be construction approximately 20 feet west of the concrete pad in a north-south orientation extending to the established vegetation (brush). The fence will be constructed on metal T-posts driven into the ground with 4-foot high orange safety fence attached. Vehicle traffic within the limits of the exclusion zone will be limited to site construction equipment. The approximate location of the security fence denoting the exclusion zone is illustrated in Figure 3.

Analytical data from previous investigations indicate that the surface PCB impacted soil has been removed. Intrusive activities proposed during this phase of the RA are limited to soil borings and vault sampling. Soil cuttings and fill materials located in the vault will be tested and managed accordingly to prevent the transfer of impacted materials outside of the exclusion zone.

3.0 SITE REMEDIAL IMPLEMENTATION PLAN

The results of the sampling activities will be summarized in a brief letter report. The report will include a summary of the sampling activities, description of the site conditions, results of the chemical laboratory analyses, and proposed RA. Drawings will be prepared to illustrate the sample locations and proposed RA. The laboratory analytical data will be summarized in a table. The field notes, sample collection logs, chain-of-custody, and laboratory report will be provided as appendices.

Tables

Table 1
Proposal Sampling Intervals
Former GST Steel Facility
Kansas City, Missouri

Sample ID	Excavation	Excavation Depth (ft)	Sample Interval (ft)				
Confirmation samples							
CS-108	Northeast Pad	5.5	6-8	8-10	10-12	---	---
CS-112W	Northeast Pad	5.5	6-8	8-10	10-12	---	---
CS-113W	Northeast Pad	5.5	6-8	8-10	10-12	---	---
CS-117	Northeast Pad	5.5	6-8	8-10	10-12	---	---
CS-110N	North	3.5	4-6	8-10	---	---	---
CS-106N	North	3.5	4-6	8-10	---	---	---
CS-102	East	10	10-12	14-16	17-19	---	---
202	East	10	10-12	14-16	17-19	---	---
CS-101S	Southeast	4	4-6	6-8	10-12	---	---
Characterization Samples							
CS-301	Southeast	4	2-4	4-6	6-8	10-12	---
CS-302	Southeast	4	2-4	4-6	6-8	10-12	---
CS-303	East	10	2-4	4-6	6-8	10-12	---
CS-304	East	10	2-4	6-8	10-12	14-16	18-20
CS-305	East	10	2-4	6-8	10-12	14-16	18-20
CS-306	East	10	2-4	6-8	10-12	14-16	18-20
CS-307	East	10	2-4	6-8	10-12	14-16	18-20
CS-308	East	10	2-4	6-8	10-12	14-16	18-20
CS-309	East	10	2-4	6-8	10-12	14-16	18-20

Samples to be analyzed first.

Figures

Appendices

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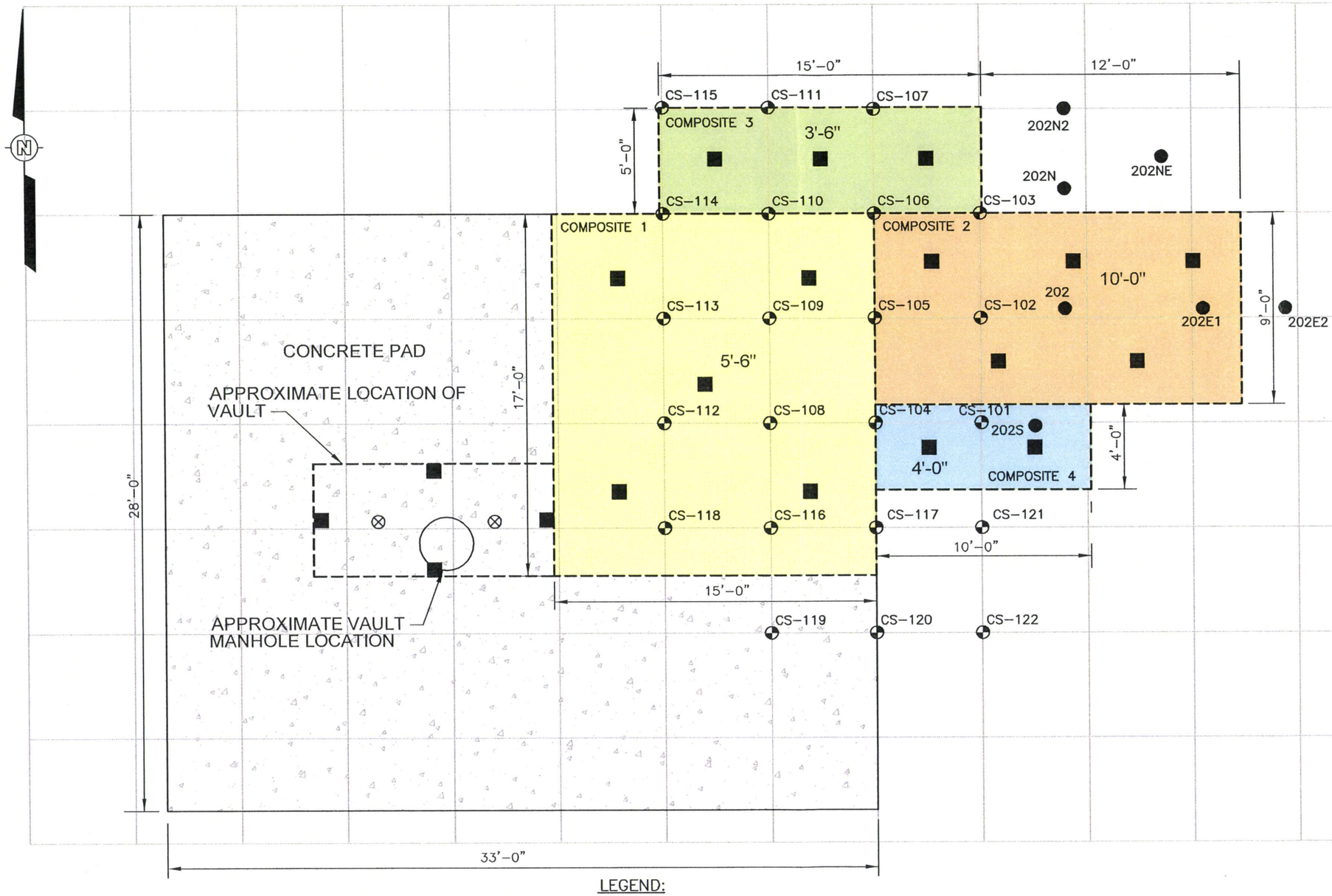

LEGEND:

- PREVIOUS SAMPLE LOCATION
- COMPOSITE SAMPLE LOCATION
- NORTHEAST PAD AREA
- EAST AREA
- NORTH
- SOUTHEAST AREA
- CONCRETE CHIP SAMPLE LOCATION

SCALE
0 5 10 FEET

REFERENCE:

REFERENCE ALL DRAWINGS FROM OTHER SOURCES HERE.

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MILE RAIL, LLC
KANSAS CITY, MISSOURI

FIGURE 1
PROPOSED FILL MATERIAL
COMPOSITE SAMPLE
FORMER GST STEEL
KANSAS CITY, MISSOURI

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LEGEND:

- FORMER SUBSTATION
- EXCLUSION ZONE SECURITY FENCE
- DECONTAMINATION AREA
- TRACT F-7

N

0 25 50 100

Feet

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MILE RAIL, LLC
KANSAS CITY, MISSOURI

FIGURE 3
SITE DETAILS MAP
FORMER GST STEEL
KANSAS CITY, MISSOURI

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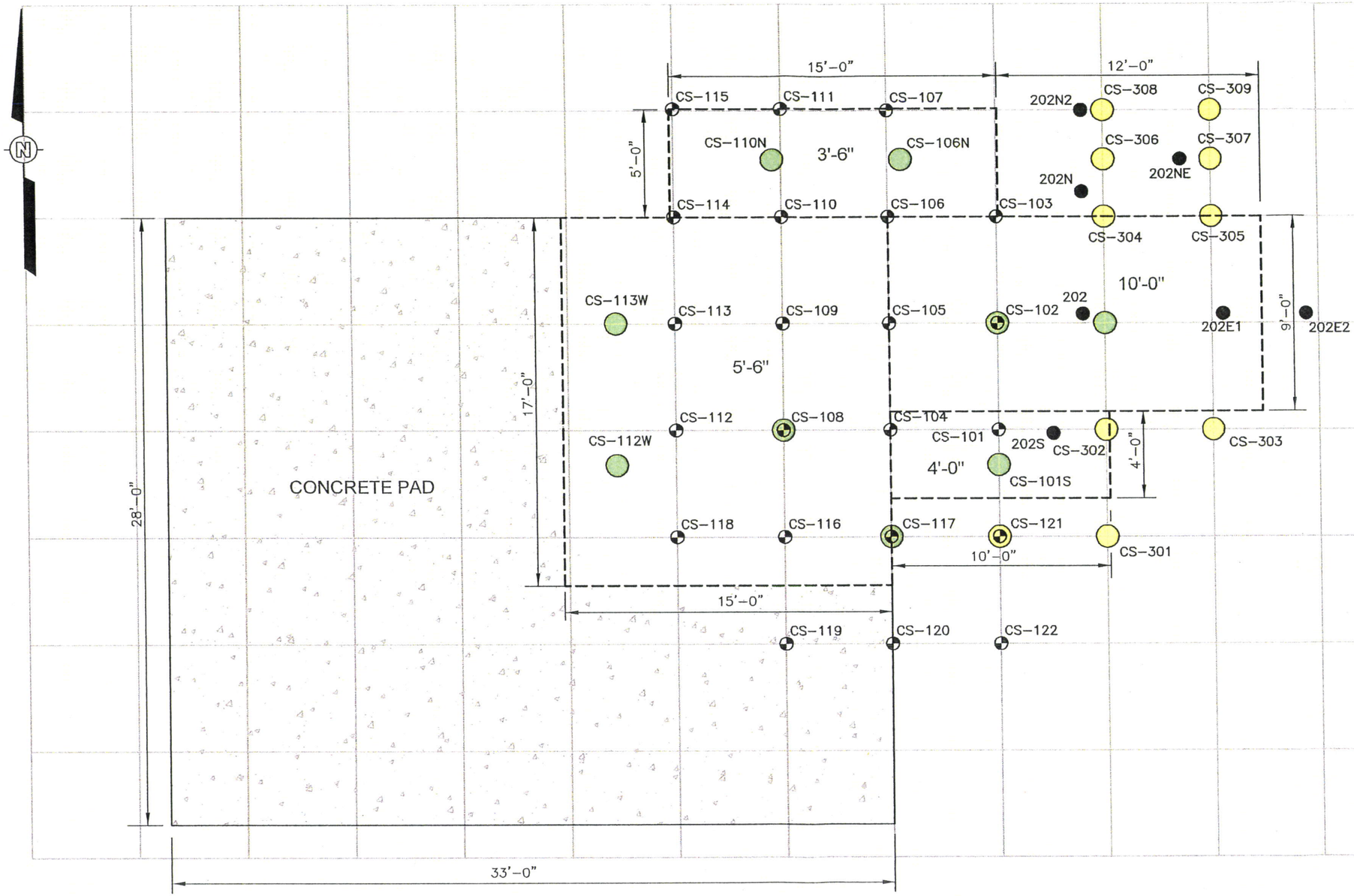

LEGEND:

- PREVIOUS SAMPLE LOCATION
- PROPOSED CONFIRMATION SAMPLE
- PROPOSED CHARACTERIZATION SAMPLE

SCALE

0 5 10 FEET

REFERENCE:

REFERENCE ALL DRAWINGS FROM OTHER SOURCES HERE.

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MILE RAIL, LLC
KANSAS CITY, MISSOURI

FIGURE 2

PROPOSED SAMPLE LOCATIONS

FORMER GST STEEL
KANSAS CITY, MISSOURI

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Appendix A

Standard Operating Procedures

1. PURPOSE

This procedure is intended to communicate the requirements for selection, use, and maintenance of all field logbooks. Field logbooks are often used to document observations, sampling information, and other pertinent information on project sites. They are considered legal documents and should be maintained and documented accordingly as part of the project file.

2. SCOPE

This procedure is applicable to all Shaw E & I site operations where field logbooks are utilized to document all site activities and pertinent information.

3. REFERENCES

- Nielsen Environmental Field School, 1997, *Field Notebook Guidelines*

4. DEFINITIONS

- **Significant detail**—Any piece and/or pieces of information or an observation that can be considered pertinent to the legal reconstruction of events, description of conditions, or documentation of samples and/or sampling procedures.
- **Significant event**—Any event or events that could influence or be considered pertinent to a specific task or function and therefore require documentation in the Field Logbook.
- **Field Logbook**—Logbooks used at field sites that contain detailed information regarding site activities that must include dates, times, personnel names, activities conducted, equipment used, weather conditions, etc. Field logbooks can be used by a variety of different field personnel and are part of the project file.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

use, the information on the form need not be duplicated in the field logbook. However, any forms used to record site information *must be referenced* in the field logbook.

- Information must be factual and unbiased.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Write in black or dark blue indelible ink.
- Do not erase, scribble over, or blot out any entry. Do not use White-Out or like correction items. Before an entry has been signed and dated, changes may be made; however, care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted. Any change shall be initialed and dated. Error codes (Attachment 1) should be added to the end of the deleted entry. All error codes should be circled.
- Do not remove any pages from the book.
- Do not use loose paper and copy into the field logbook later.
- Record sufficient information to completely document field activities and all significant details/events applicable to the project/task(s) covered by the logbook.
- All entries should be neat and legible.

Specific requirements for field logbook entries include the following:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial, date, and if used, code all changes properly.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:

  a) Date and time

  b) Name of individual making entry

  c) Detailed description of activity being conducted including well, boring, sampling, location number as appropriate

  d) Unusual site conditions

  e) Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction and speed) and other pertinent data

  f) Sample pickup (chain-of-custody form numbers, carrier, time)

  g) Sampling activities/sample log sheet numbers

  h) Start and completion of borehole/trench/monitoring well installation or sampling activity

  i) Health and Safety issues, such as PPE upgrades, monitoring results, near-misses, and incidents associated with the logbook areas

  j) Instrumentation calibration details

clear, precise, and as non-subjective as possible. Field logbooks, and entries within, are not to be utilized for personal use.

7. ATTACHMENTS

- Attachment 1, Common Data Error Codes

8. FORMS

None

9. RECORDS

- Field Logbook

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 6/5/2003	Initial Issue	N/A
01 9/8/2006	New template, new numbering of procedure, Section 1 Purpose- content added, Section 2 edited, Section 4-Definitions edited. Sections 6.2, 6.3, 6.4, 6.5 and 6.6 were all edited.	Guy Gallello
02 8/25/2011	Modified format only to align with Governance Management framework	Scott Logan

1. PURPOSE

The purpose of this procedure is to provide the requirements for completion of written Chain of Custody (COC) documentation and to provide a suggested Chain of Custody Form for project use.

2. SCOPE

This procedure is applicable to all Shaw E & I efforts where samples are transferred among parties, including to off-site testing facilities. Adherence to this procedure is not required whenever the same individual/team is performing the sampling and testing within the same workday, and transfer to the testing process is being documented by other means, e.g. sampling and then field-screening in a mobile laboratory.

3. REFERENCES

- U.S. Environmental Protection Agency, 1986, *Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846*, Third Edition.
- U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans*, EM200-1-3.
- Shaw E & I, 2002, *Sampler's Training Course Handout.*

4. DEFINITIONS

- **Custody**—The legal term used to define the control and evidence traceability of an environmental sample. A sample is considered to be in an individual's custody when it is in actual physical possession of the person, is in view of the person, is locked in a container controlled by the person, or has been placed into a designated secure area by the person.
- **Chain of Custody Form**—A form used to document and track the custody and transfers of a sample from collection to analysis or placement in a designated secure area within the testing facility.
- **COC Continuation Page**—Additional page(s) that may be included with a Chain of Custody form. The continuation page(s) contain the information on additional samples contained within the *same* cooler/shipping container associated with the cooler/shipping container Chain of Custody form.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw E & I employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

6.4 Sample Information Section–Including on Continuation Page(s)

During actual sampling, each sample must be entered on the COC form at the time of collection in order to document possession. The sampler must not wait until sampling is completed before entering samples on the COC.

- Complete the *Sample ID Number* for each line. If there are multiple container types for a sample, use additional lines to indicate the needed information.
- Ensure that the *Sample Description* matches the description on the sample label–the laboratory will use this information for cross-referencing.
- Provide the *Collection Date* and *Time*. These must match those on the sample label and Field Logbook/Logsheets.
- Indicate whether the sample is a Grab or Composite sample.
- Indicate the *Matrix* of the sample. Use the Matrix Codes listed on the Chain of Custody form.
- Indicate the *Number of Containers* and the *Container Type*. If a sample has multiple container types, use multiple lines and cross-out the information spaces to the left of the container blocks. *Failure to do this may cause the laboratory to log-in each container type as a separate sample/lab-ID, resulting in a confused report and invoice.*
  - Alternatively, if each sample has the same number/type container types, use "various" in the *Container Type* block and provide detail in the *Special Instructions* section, e.g., "Each sample consists of one 16-oz jar, two pre-weighed VOC w/DI water, and one pre-weighed VOC w/Methanol."
- Check the appropriate *Preservative* box for each line/container type.
- Write in and check the *Analyses Requested* boxes for each line/container type. The appropriate method number (e.g., EPA Method 8260C) must be written as well as the method name.
- Indicate the *Turn-around Time Requested* for each sample.
- Use the *Special Instructions* section to provide important information to the laboratory, e.g., samples that may require dilution or samples that will need to be composited by the laboratory. This section may also be used to inform the laboratory of additional information contained in attachments to the Chain of Custody package.
- Circle the appropriate *QC/Data Package Level* requested.

6.5 Custody Transfer Section

- The first *Relinquished By* space must be completed by the individual who will either transfer the samples or seal the shipping container.
- If the samples will be transferred to a courier, write the courier/carrier company in the *Received By* box and enter the Date and Time that the shipping container was closed.
- All other transfers must be performed in person, and the Relinquisher must witness the signing by the Receiver.
- A copy of the Chain of Custody form and all associated Continuation Pages should be maintained in the project files.

STANDARD OPERATING PROCEDURE

Subject: Sample Labeling

1. PURPOSE

The purpose of this procedure is to provide the requirements for completion and attachment of sample labels on environmental sample containers.

2. SCOPE

This procedure is applicable to all Shaw E & I projects/proposals where samples will be collected.

3. REFERENCES

- U.S. Environmental Protection Agency, 1986, *Test Methods for Evaluating Solid Waste; Physical/Chemical Methods*, SW-846, Third Edition.
- U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans*, EM200-1-3
- Shaw E & I, 2002, Sampler's Training Course Handout.

4. DEFINITIONS

- **Sample Label**—Any writing surface with an adhesive backing that can be used to document sample identification information. The sample label is attached to the sample container as a means of identification and, in some commercially available or laboratory-supplied containers, may be pre-attached. All Shaw E & I strategic alliance laboratories provide sample labels or pre-labeled containers in their sample container supply kits.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw E & I employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw E & I employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

1. PURPOSE

The purpose of this procedure is to establish the method for homogenizing samples prior to containerization. Proper homogenization is very important because it helps ensure that sample aliquots are representative of the whole collected sample and helps minimize sampling error so that other errors included in the measurement process, such as laboratory sample preparation and test measurement, can be better assessed.

2. SCOPE

This procedure applies to Shaw Environmental & Infrastructure (Shaw E & I) personnel responsible for the collection of environmental samples. The sample matrix must be amenable to mixing. This SOP applies to the collection of samples that are to be tested for all analytes except volatile analytes.

3. REFERENCES

- American Society for Testing and Materials (ASTM), 1998, Reducing Samples of Aggregate to Testing Size, C702.
- U.S. Army Corps of Engineers, Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, Section E-2, Homogenizing Techniques.

4. DEFINITIONS

- **Homogenize**—The use of physical mixing motions to make a uniform sample matrix.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

Sampling equipment materials shall be selected so as to minimize contamination of samples. Sampling equipment shall be either new (never used previously), documented to have been decontaminated, or dedicated to each specific sampling point. Samples for organic

adequate mixing motion for as long as needed to determine by visual observation that the sample media has taken on a uniform appearance.

6.2 Liquid Samples

Most aqueous samples do not require homogenization since water is well mixed due to diffusion and bulk convection. If the sample matrix is a viscous liquid, semi-solid, or an aqueous one with suspended solids, the sample will require mixing.

Do **not** shake the sample and do not agitate the sample in **any** way if collecting for volatile parameters. Volatile sample containers should be either filled directly from the sample source or if transferring from a large container, such as an automatic sampler reservoir, filled first and **without agitation**.

For non-volatile parameters, mix either using an appropriate stirrer or by gentle swirling and then immediately transfer the material into the appropriate containers. The sample should be mixed frequently during the container-filling step, in particular if there are a large number of containers, so that the condition of the bulk sampled fluid will be approximately the same when each parameter-specific sample container is filled.

7. ATTACHMENTS

None

8. FORMS

None

9. RECORDS

None

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 06/05/2003	Initial Issue	N/A
01 09/08/2009	Updated template and changed numbering of procedure, edited Section 1-Purpose and Section 2-Scope, deleted Section 3.1, which was misc. matrix sampling SOPs to which sample mixing/homogenization may apply, Section 6.1 was broken down into subsections, Section 6.2 was converted from Aquous Samples to Liquid Samples and content was added.	Guy Gallello
02 08/25/2011	Modified format only to align with Governance Management Framework	Scott Logan

1. PURPOSE

This procedure is intended to provide guidelines for the compositing of samples collected in the course of environmental program activities. Composites represent the average distribution of properties and can be used to reduce analytical costs or represent well-defined decision boundaries.

2. SCOPE

This procedure applies to the compositing of solid and liquid samples where no project-specific process is in place. Field composite methods are not appropriate for Volatile Organic Compounds (VOC) analysis of solids. Composites for these methods must be laboratory derived using either individual grab extracts or other laboratory methods.

3. REFERENCES

- U.S. Environmental Protection Agency, 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, Washington, DC.
- Shaw E & I Standard Operating Procedure EID-FS-010, *Sample Mixing/Homogenization.*

4. DEFINITIONS

- **Composite Sample**—A sample that is comprised of roughly equal amounts of discrete grabs from a set of sample locations or time/flow increments known as a *sample group.*
- **Sample Group**—A predetermined number or time/area span of discrete samples, which is composited into one sample for analytical purposes.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw E & I employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw E & I employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager or designee is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

- Using clean glass pipets, deliver equal volumes from each grab container to the composite sample container that is to be shipped to the lab. For example, if there are five grab samples, and the composite sample requires 100 mL for the parameter of interest, pipet 20 mL from each of the grab samples into the composite sample container.
- Alternatively, measured volumes can be determined via a graduated cylinder/beaker and combined. The measuring container should be decontaminated between composites.
- Cap/seal the composite container and swirl to agitate. Stirring should be avoided as it increases the risk of introducing contamination to the sample.
- Label the sample(s), document the event, and package/ship the sample(s) as required.

7. ATTACHMENTS

None

8. FORMS

None

9. RECORDS

None

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 08/14/2003	Initial Issue	N/A
01 09/08/2006	Updated template and numbering of procedure changed, updated Section 2-Scope, added content to 6.1 and 6.2.	Guy Gallello
02 08/25/2011	Modified format only to align with Governance Management framework.	Scott Logan

1. PURPOSE

The purpose of this procedure is to provide general instructions in the packaging and shipping of non-hazardous samples. The primary use of this procedure is for the transportation of samples collected on site to be sent off site for physical, chemical, and/or radiological analysis.

2. SCOPE

This procedure applies to the shipping and packaging of all non-hazardous samples. Non-hazardous samples are those that do not meet any hazard class definitions found in 49 CFR 107-178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances) and/or materials that are not classified as *Dangerous Goods* under current IATA regulations.

In general most soil, air, and aqueous samples, including those that are acid or caustic preserved do **not** qualify as *hazardous materials* or *dangerous goods*. An exception is methanolic soil VOC vials: these containers are flammable in any quantity and **must** be packaged, shipped, and declared as *Dangerous Goods* whenever transported by air.

The Class 9 "Environmentally Hazardous" designation should only be applied to samples if they are known or suspected (via screening) to contain a sufficient concentration of contaminant to pose a health and/ or environmental risk if spilled in transport. Samples for which screening has shown a potential hazard (i.e. flammability) or those that are derived from a known hazard, including a site/facility with confirmed contamination by an *infectious substance* must also be shipped in accordance with the applicable DOT/IATA requirements. Refer to Shaw E & I SOP FS013.

Improper shipment of hazardous materials, especially willful misrepresentation and shipment as non-hazardous materials, is a violation of federal law and is punishable by fines and possible imprisonment of the guilty parties. It is also a violation of Shaw E & I policy and can result in disciplinary action up to and including termination of employment.

3. REFERENCES

- U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, EM200-1-3, Washington, D.C.
- U.S. Department of Transportation Regulations, 49 CFR Parts 108-178
- International Air Transport Association (IATA), *Dangerous Goods Regulations*, current edition.

4. DEFINITIONS

- **Cooler/Shipping Container**—Any hard-sided insulated container meeting DOT's or IATA's general packaging requirements.
- **Bubble Wrap**—Plastic sheeting with entrained air bubbles for protective packaging purposes.

6.2 Labeling

- A "This Side Up" arrow should be adhered to all sides of the cooler, especially ones without obvious handles.
- The name and address of the receiver and the shipper must be on the top of the cooler.
- The airbill must be attached to the top of the cooler.

6.3 Shipping Documentation

- A Cooler Shipment Checklist (Attachment 1) should be completed and kept in the project file.

7. ATTACHMENTS

- Attachment 1, Shaw E & I Cooler Shipment Checklist

8. FORMS

None

9. RECORDS

- Chain of Custody Form
- Chain of Custody Continuation Page(s)
- Cooler Shipment Checklist

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 06/05/2003	Initial issue	N/A
01 09/08/2006	Updated template and numbering of procedure, content was added to Section 2-Scope	Guy Gallello
02 08/25/2011	Modified format only to align with Governance Management framework.	Scott Logan

1. PURPOSE

This procedure is intended to provide minimal guidelines for the decontamination of contact sampling equipment. Contact sampling equipment is equipment that comes in direct contact with the sample or the portion of a sample that will undergo chemical analyses or physical testing.

2. SCOPE

This procedure applies to all instances where non-disposable direct contact sampling equipment is utilized for sample collection and no project-specific procedure is in place. This procedure is not intended to address decontamination of peristaltic or other sampling pumps and tubing. The steps outlined in this procedure must be executed between each distinct sample data point.

3. REFERENCES

- U.S. Environmental Protection Agency, Region 4, 2001, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, 980 College Station Road, Athens, Georgia. November.
- US Army Corp of Engineers, Washington, D.C., 2001, Requirements for the Preparation of Sampling and Analysis Plans (EM-200-1-3), February.

4. DEFINITIONS

- **Soap**—A standard brand of phosphate-free laboratory detergent, such as Liquinox®.
- **Organic Desorbing Agent**—A solvent used for removing organic compounds. The specific solvent would depend upon the type of organic compound to be removed. See Attachment 1 for recommendations.
- **Inorganic Desorbing Agent**—An acid solution for use in removing trace metal compounds. The specific acid solution would depend upon the type of inorganic compound to be removed. See Attachment 1 for recommendations.
- **Tap water**—Water obtained from any municipal water treatment system. An untreated potable water supply can be used as a substitute for tap water if the water does not contain the constituents of concern.
- **Distilled Water**—Water that has been purified via distillation. Distilled water can be purchased in most stores and is acceptable as a final rinse in non-trace analytical decontamination processes. Examples would include disposal profiling, HazCat, and other gross screening applications.
- **Analyte-free water**—Water that has been treated by passing through a standard deionizing resin column, and for organics either distillation or activated carbon units. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds, and/or no detectable organic compounds (i.e., at or above analytical detection limits). Type I and Type II Reagent Grade Water meet this definition as does most laboratory-supplied blank water.

9. RECORDS

None

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 06/05/2003	Initial issue	N/A
01 09/08/2006	Updated template and updated numbering of procedure, Sections 1 and 2 minor edits, added definition for Distilled Water, Section 6- extensive content changes	Guy Gallello
02 08/25/2011	Modified format only to align with Governance Management Framework	Scott Logan

1. PURPOSE

The purpose of this document is to provide the methods and procedure for sampling of soils and other solids using hand auger techniques. Hand auger sampling can be used when matrices are composed of relatively soft and non-cemented formations, to reach depths of up to 5 feet below ground surface, dependent on site conditions. Samples for Volatile Organic Compound (VOC) analysis should not be collected via hand auger methods. However, a hand auger may be utilized to penetrate to and expose the undisturbed material at the desired depth for sampling by more applicable methods.

2. SCOPE

This procedure is applicable to all Shaw E & I projects where soil samples will be collected via hand auger methods and no project-specific procedure exists.

3. REFERENCES

- U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, Appendix C, SectionC.6, EM200-1-3, Washington, D.C.
- American Society of Testing and Materials, D1452-80 (re-approved 2000), *Standard Practice for Soil Investigation and Sampling by Auger Borings*, West Conshohocken, PA.

4. DEFINITIONS

- **Hand Auger**—A sample collection device consisting of metal rods with a T-bar handle and a detachable metal head. The auger head is a hollow metal tube with two cutting edges at the bottom curved into each other to hold the material pushed up into the tube as the auger is forced deeper. All trace environmental samples should be collected using stainless steel auger heads. See ASTM D1452 for a description of various types of augers available for use.
- **Sand Auger**—A type of auger with the cutting edges bent toward and touching each other. The design allows for the trapping of loosed materials in the auger tube.
- **Mud Auger**—A type of auger head with the top several inches open at the sides to allow for reduction of suction during removal from wetted and highly plastic materials, such as mud and lagoon solids.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

9. Homogenize the non-VOC sample and transfer the sample directly into the sample container(s). Cap the sample container(s), label, complete documentation, and place into the sample cooler.

10. Measure the depth from which the sample was taken and record it in the field logbook or sheet.

11. Repeat steps 4 through 10 for deeper samples from the same hole.

7. ATTACHMENTS

None

8. FORMS

None

9. RECORDS

- Measurements recorded in Field Logbook or Field Logsheet
- Field Logsheet

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 08/17/2003	Initial issue	N/A
01 09/08/2006	Updated template and numbering of procedure, Minor edits to Section 1-Purpose.	Guy Gallello
02 08/25/2011	Modified format only to align with Governance Management Framework	Scott Logan

1. PURPOSE

The purpose of this procedure is to provide the methods and procedures for collection of chip samples from surface and near-surface areas of hard porous materials such as concrete, brick, and wood. This procedure is applicable to sampling to determine surface to near-surface (½-inch) contaminant distribution.

2. SCOPE

This procedure is applicable to all Shaw E & I projects where chip samples of hard porous surfaces are collected and no project-specific procedure is in use.

3. REFERENCES

- U.S. Army Corps of Engineers, 2001, *Requirements for the Preparation of Sampling and Analysis Plans*, Appendix C, SectionC.7, EM200-1-3, Washington, D.C.

4. DEFINITIONS

- **Chip Sample**—A sample collected from and representative of the surface and near-surface properties of the sampled medium. Chip samples are usually collected from pads, walls, poles/ties, and other hard porous materials where contaminants may have penetrated slightly beyond the surface. They should not be used to characterize contaminant distribution/penetration beyond a half of an inch. In these cases, core samples are more appropriate.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be directed to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw E & I employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw E & I employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

Safety Note: *Proper PPE including a face shield should be worn when performing this procedure, especially on concrete surfaces. Chips and fine particles may enter the eyes or strike the face causing severe injury. Only trained individuals should operate a hammer drill. Keep non-involved personnel away from the sampling area.*

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 08/17/2003	Initial issue.	N/A
01 09/21/2006	Updated template and numbering of procedure, Updated Section 2-Scope.	Guy Gallello
02 08/25/2011	Modified format only to align with Governance Management framework.	Scott Logan

STANDARD OPERATING PROCEDURE

Subject: Standards for Conducting Direct Push Drilling and Soil Sampling

1. PURPOSE

This procedure provides the standard practice for direct push drilling and soil sampling. The procedure provides the minimum required steps and quality checks that employees and subcontractors are to follow when performing the subject task.

This procedure may also contain guidance for recommended or suggested practice that is based upon collective professional experience. Recommended or suggested practice goes beyond the minimum requirements of the procedure and should be implemented when appropriate.

2. SCOPE AND RELATED STANDARDS

Geosciences Standard Operating Procedure (SOP) EI-GS021 describes standards for direct push drilling and soil sampling, and discusses how such drilling and sampling will be conducted and documented for projects executed by Shaw Environmental & Infrastrucure Inc. (Shaw E & I). Responsibilities of individuals performing the work are also detailed. Additional project-specific requirements for direct push drilling and soil sampling may be developed, as necessary, to supplement this procedure and to address project-specific conditions and/or objectives.

This SOP covers requirements for collection of soil and unconsolidated materials by direct push methods primarily for laboratory or other testing and for lithologic description or analysis (logging). It describes basic equipment and procedures and addresses aspects of the process where quality must be maintained. It does not address procedures for specific brands of equipment, or for uncommon purposes of boring or sampling. Other types of soil and rock sampling while drilling are addressed in other Shaw E & I technical SOPs.

3. REFERENCES (STANDARD INDUSTRY PRACTICES)

The methodology for direct push drilling and soil sampling should follow industry standard practices. The latest revision of the following references are relevant and useful for planning and conducting direct push drilling and soil sampling:

ASTM D 6282	Direct Push Soil Sampling for Environmental Site Characterizations
ASTM D 6286	Standard Guide for Selection of Drilling Methods for Environmental Site Characterization

4. DEFINITIONS

The following definitions are applicable to direct push drilling and soil sampling and this SOP.

- **Direct push drilling**—The creation of a boring by the displacement of soil without cutting or grinding and without the production of mechanically-altered soil (cuttings) at the ground surface. In direct push drilling, soil is displaced, primarily laterally, as a pipe or rod is forced vertically downward, creating a cylindrical space (i.e. a boring). Energy to create the boring may be generated from constant pressure (e.g., hydraulically-powered), vibration, or other means.

- **Slough**—Slough is soil or other earth material that has been dislodged from its original location within the boring and displaced elsewhere within the boring (usually to the bottom). The creation

- Detailed direct push drilling and subsurface soil sampling requirements or procedures based upon site-specific conditions and project-specific objectives/requirements

6.1 Selection of Methods and Equipment

The practice of direct push drilling and soil sampling involves numerous variations in methodology and types of equipment. There are few industry-wide standards for direct push drilling and soil boring. Key aspects of the variations in direct push drilling and sampling are as follows:

- **The use of single-wall or dual-wall sampling systems**. Single-wall systems generally provide lower-quality sampling and higher rates of production than dual-wall systems. Single-wall systems can typically be advanced with lower energy sources (i.e., to greater depth) than dual-wall systems because they have smaller area and hence encounter less sidewall friction and tip resistance during advance.

- **Open-hole or cased boring**. *This SOP recommends that borings always be advanced through or with a conductor casing.*

- **Open-barrel or closed (sealed)-barrel sampler**. Open-barrel samplers are open at the bottom at all times, and may fill with slough, lose sample material as they are retrieved, or contribute to or be subject to cross-contamination. Closed-barrel samplers are closed at the bottom until being mechanically opened at a target depth. Closed-barrel samplers reduce the potential for sampling of slough or cross-contamination of the sample.

- **Liner or inner-barrel material**. Inner barrel/sampler tubes should be selected based on the need to see or access samples for lithologic evaluation and the need to perform chemical or other analytical testing. Use of lexan or other see-through materials can be beneficial in identifying soil type or visual indications of contamination (such as petroleum saturation). Some liners, such as lexan, can be quickly cut to select certain sample intervals for testing, and the sample may be retained, shipped, and stored directly in the liner. Liners or sample barrel material should generally not be made of materials that include any of the chemical species that are sought during analysis.

- **Energy source for making the boring**. Energy sources may be static or dynamic, and may include vibratory or sonic systems, hydraulic systems, percussion (hammer) systems, or even rotational systems.

- **Energy source for removing the sampler**. Energy sources may be static or dynamic, and are generally one of the following: hydraulically-lifted rod systems, winch and wire rope systems, or percussive systems (backpounding). This SOP recommends against backpounding as a means of removing samplers, as it tends to disturb samples.

- **Use of checkball or open-top tubes for collection of soil**. Checkball systems prevent fluids that are within the sampling barrel, above the sample, from flowing down into the barrel as the sampler is retrieved. Checkball systems are mostly used when sampling granular soils beneath the water table, to minimize the potential for water to dislodge or alter sample material as the barrel is retrieved.

- **Use of catchers or retainers**. Catchers are used to help retain loose soils within the sampling barrel as it is retrieved. Catchers are most commonly used when sampling granular soils beneath the water table, with variable success.

plan and other applicable Shaw E & I policies and procedures, such as HS316, *Drilling Operations*, and HS-308, *Underground/Overhead Utility Contact Prevention*. Additional health and safety requirements include the following:

- Tailgate Safety Meetings should be held in the manner and frequency stated in the project health and safety plan. All Shaw E & I and subcontractor personnel at the site should have appropriate training and qualifications as specified by the project health and safety plan. Documentation should be kept readily available in the project files on site.
- During drilling, all personnel within the exclusion zone should pay close attention to all rig operations. Pushed or driven drill tools can catch or snag loose clothing, causing serious injury.
- Clear communication signals must be established with the drilling crew, since verbal communication may not be heard during the drilling process.
- The entire crew should be made aware to inform the rig geologist when any unforeseen hazard arises or when anyone is approaching the exclusion zone.

6.4 Drilling and Sampling Requirements/Procedures

This SOP cannot present a single, detailed and specific procedure that is applicable to all methods and equipment that are available (Section 6.1) or to the specific sampling objectives of a specific project. An example procedure for direct push drilling and soil sample collection is shown in Attachment 1. The example procedure may be supplemented or customized to provide project-specific requirements and procedures.

Sample quality is easily compromised by poorly selected samples or haphazard drilling and sampling technique. Common problems and suggested solutions include the following:

- Generation of excess slough. Excess sloughing occurs when conductor casing is not used, when soil materials fall out of the sample barrel as it is retrieved, and when soil at or near the ground surface falls into the boring. Slough is excess when the amount that is present hinders the collection of sufficient representative sample volume or mass for the required testing or lithologic analysis.
- Collection of slough for testing or logging. This occurs when a large volume of slough is present in the boring bottom at the time the sampler is emplaced and driven into soil. Because slough is disturbed and from unknown depth, it is unsuitable for logging or testing.
- Disturbance (negatively-biasing) of samples for analysis of Volatile Organic Compounds (VOCs). The act of driving a sampling tube into soil causes compression and some heating of the soil, and can create macroscopic void space, i.e., a microannulus between the soil and sampling tube. Heating, compression of soil, and creation of void space contribute to the migration of gaseous fluids as well as the partitioning of VOCs, such as gasoline or solvent vapors. Although some heating, compression, and formation of microannular space are unavoidable, care should be taken to minimize these phenomena to the extent that is reasonably possible. Some sampling devices and methods are more suitable for analysis of samples for VOCs than others.
- Improper abandonment of borings. Excess slough or caving (the dislodgement and falling of a significant volume of sidewall material) hinders the proper abandonment of a boring. Where this occurs, the borehole should be cleaned out prior to grouting. A tremmie pipe should be used to conduct grout to the bottom of the borehole if a conductor casing is not in place prior to and during grouting.

- Comments/issues that arise relative to the results of drilling and sampling activities should be resolved before external (i.e., outside of Shaw E & I) use or submission of the results.

The technical review comments and issues, and corresponding resolution, shall be documented and filed with the project records. Such records should be maintained until project closeout.

7. ATTACHMENTS

- Attachment 1, Example Direct Push Drilling and Soil Sampling Procedure

8. FORMS

None.

12. Pull the wireline sampling string up from the bottom of the borehole and remove the sample barrel. Make sure that each sample barrel is retrieved as quickly and smoothly as possible. Record the depth interval for each sample drive as the sample barrel is being retrieved.

13. Remove the acrylic liner containing the soil sample from the sample barrel.

14. Observe and record the amount of sample recovery on the appropriate form(s), according to applicable Shaw E & I procedures and/or the project work plans. Any observed field problems associated with the sampling attempt (e.g., refusal) or lack of recovery should be noted on the appropriate form.

15. Select the appropriate portion of the liner containing the sample to be cut and be submitted for laboratory analysis. Such selection should be based on the following factors: (1) judgment that the sample represents relatively undisturbed intact material, not slough; (2) volume/length of sample required for analysis; (3) minimal exposure to air; (4) lithology; and (5) obvious evidence of contamination. The project work plans should specify the volume/length of sample to be submitted for specific analyses and confirm the selection factor(s).

16. Place Teflon™ film over each end of the liner containing the samples to be submitted for chemical analysis and seal each end with plastic end caps. Do not use any type of tape to seal the cap, because tape causes a toluene interference. All samples should be individually stored in resealable plastic bags. Note: Additional project-specific sample preparation steps or modifications may be required as stated in the project work plans.

17. Appropriately label and number each sample to be submitted for analysis according to applicable Shaw E & I technical SOPs and the project work plans. The label will be filled out using waterproof ink and may contain, at a minimum, the following information:

    - Project number
    - Boring number
    - Sample number
    - Bottom depth of sleeve
    - Date and time of sample collection
    - Parameters of analysis
    - Sampler's initials

18. Document the sampling event on the appropriate form(s), as specified in the project work plans. The information listed on the form(s) should, at a minimum, include the following:

    - Project name and number
    - Date and time of the sampling event
    - Sampling methods used – specify sample type
    - Sample number
    - Sample location
    - Sample depth interval
    - Sample description (type of matrix)
    - Weather conditions
    - Unusual events, including lack of water or insufficient water volume in sampler
    - Signature or initials of sampler

27. If a monitoring well is to be installed in the borehole, follow appropriate Shaw E & I technical SOPs and project-specific requirements/procedures. The well installation will be supervised by the rig geologist.

28. After drilling, sampling, and well installation or borehole abandonment is completed, lay the conductor casing down and move the rig off of the location. The rig geologist or appropriate designee will supervise demobilization/site restoration. Additional demobilization requirements/ procedures are as follows:

    - All debris generated by the drilling operation should be removed and disposed of appropriately.
    - The site should be cleaned, the ground washed as necessary, and the site conditions restored according to the project work plans.
    - All abandoned borings should be topped off and completed as specified by the project work plans. All wells should also have their surface completions finished as specified by the project work plans.
    - Any hazards remaining as a result of drilling activities should be identified and appropriate barriers and markers put in place, as specified by the project health and safety plan.
    - All soil cuttings and fluids should be properly contained, clearly labeled, and maintained in compliance with the project work plans and/or other applicable requirements.

29. Complete all appropriate forms and documentation as required in the project work plans.

Appendix B

Forms

Shaw The Shaw Group Inc.

JOB SAFETY ANALYSIS
TAILGATE SAFETY MEETING
COMBINATION FORM

JOB#:

JSA Date:

Date Revised:

Project name: Client: Preparer(s): EMERGENCY INFO (list below or attach) Hospital Name: Address: Phone: Ambulance Phone: Emergency Evacuation route: Assembly point:	ACTIVITY DESCRIPTION: Supervisor: Initials: Time of inspection: Comments:
Initial Required PPE:	

PRINCIPLE TASKS, STEPS	POTENTIAL HEALTH/SAFETY HAZARDS	RECOMMENDED CONTROLS

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS

Tailgate Safety Meeting Conducted by: Date: Time:

OTHER TOPICS DISCUSSED:	ATTENDEES' Printed Names	ATTENDEES' Signatures

CHAIN OF CUSTODY

Shaw™ Shaw E & I

Ref. Document # _____

Page _____ of ___

Project Number: _____

Project Name / Location: _____

Purchase Order #: _____

Project Contact: _____
(Name & phone #)

Shipment Date: _____

Waybill/Airbill Number: _____

Lab Destination: _____

Lab Contact Name / ph. #: _____

Send Report To: _____

Phone/Fax Number: _____

Address: _____

City: _____

Sampler's Name(s): _____

Sample ID Number	Sample Description	Collection Information: Date	Time	G/C	Matrix	# of containers	Container type	Preservative: HCL	NaOH	HNO_3	H_2SO_4	Ice		Analyses Requested	Turn Around Time Requested

Special Instructions:

QC/Data Package Level Required:
I II III IV/Project Specific: _____

Relinquished By:	Date: / Time:	Received By:	Date: / Time:
Relinquished By:	Date: / Time:	Received By:	Date: / Time:
Relinquished By:	Date: / Time:	Received By:	Date: / Time:

G/C Codes

C = Composite G = Grab

Matrix Codes

DW = Drinking Water	SO =Soil
GW = Ground Water	SL = Sludge
WW = Waste Water	CP = Chip Samples
SW = Surface Water	WP = Wipe Samples
LIQ = Other Liquid	SOL = Other Solid
AS = Air Sample	SED = Sediment

COC Continuation Page

COC Ref. Document # _____ Page _____ of _____

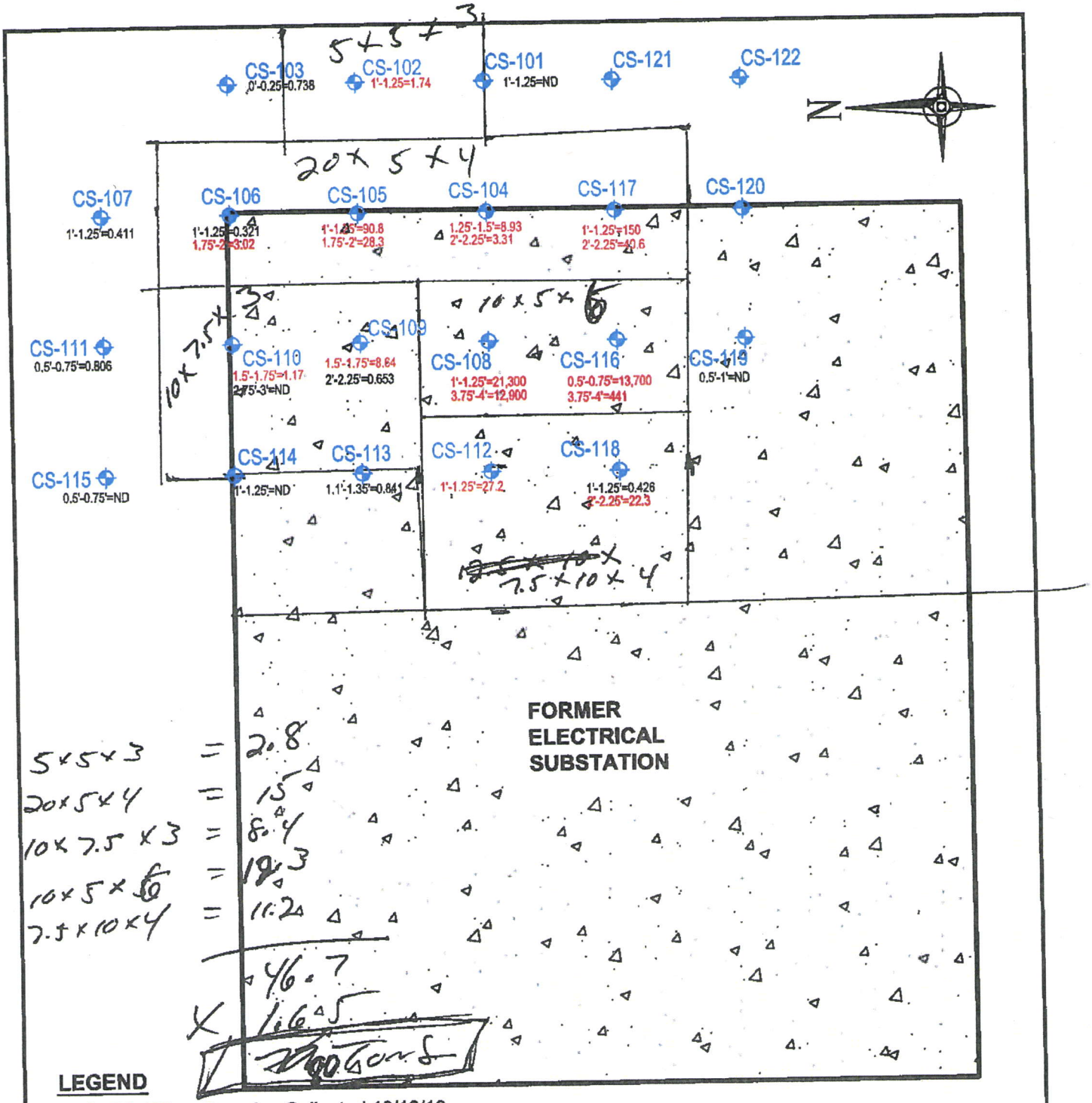
Project Number: _____ Shipment Date: _____

Project Name / Location: _____

Sample ID Number	Sample Description	Collection Information			Matrix	# of containers	Container type	Preservative						Analyses Requested										Turn Around Time Requested
		Date	Time	G/C				HCL	NaOH	HNO_3	H_2SO_4	Ice												

Appendix C

Historic Data



LEGEND

CS-102 = Samples Collected 10/19/10

1.5'-1.75'=8.64
2'-2.25'=0.653
= Sample Depth and Results (Red = Impact Above Most Stringent EPA Remediation Objective)

Date:	November 2010
Scale:	1" = 5'
Drawn by:	SP
Checked by:	JK

Exhibit III: Proposed Sampling Plan
Former GST Steel Facility
Tract F-7
Kansas City, MO

COMPASS BIG BLUE, LLC
8116 Wilson Road
Kansas City, Missouri 64125

TABLE A

Soil Analytical Results
PCBs

Compass Big Blue - Tract F-7
8116 Wilson Road
Kansas City, Missouri

	EPA Remediation Objectves		Sample	CS-101	CS-102	CS-103	CS-104	CS-104	CS-105	CS-105	CS-106
			Date	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10
Analyte	**Low Occupancy**	**High Occupancy**	**Depth (feet)**	1'-1.25'	1'-1.25'	0'-0.25'	1.25'-1.5'	2'-2.25'	1'-1.25'	1.75'-2'	1'-1.25'
PCB-1016	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1242	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	1	25		0.882	**1.74**	0.738	**8.93**	**3.31**	**90.8**	**28.3**	0.321

NOTES:

1. All results expressed in milligrams per kilogram.
2. ND = Not Detected at or above adjusted reporting limit.
3. Samples were analyzed utilizing EPA Method 8082.
4. **Bold values** = Concentration exceeds EPA Low Occupancy remediation objective.
5. [ ] = Concentration exceeds EPA High Occupancy remediation objective.

TABLE A

Soil Analytical Results
PCBs

Compass Big Blue - Tract F-7
8116 Wilson Road
Kansas City, Missouri

Analyte	*EPA Remediation Objectves*		Sample Date	CS-106	CS-107	CS-108	CS-108	CS-109	CS-109	CS-110	CS-110
			10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10
	Low Occupancy	High Occupancy	Depth (feet)	1.75'-2'	1'-1.25'	1'-1.25'	3.75'-4'	1.5'-1.75'	2'-2.25'	1.5'-1.75'	2.75'-3'
PCB-1016	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1242	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	1	25		ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	1	25		**3.02**	0.411	**21,300**	**12,900**	**8.64**	0.653	**1.17**	ND

NOTES:

1. All results expressed in milligrams per kilogram.
2. ND = Not Detected at or above adjusted reporting limit.
3. Samples were analyzed utilizing EPA Method 8082.
4. **Bold values** = Concentration exceeds EPA Low Occupancy remediation objective.
5. [shaded] = Concentration exceeds EPA High Occupancy remediation objective.

TABLE A

Soil Analytical Results
PCBs

Compass Big Blue - Tract F-7
8116 Wilson Road
Kansas City, Missouri

Analyte	*EPA Remediation Objectves* Low Occupancy	High Occupancy	Sample Date	CS-111 10/19/10	CS-112 10/19/10	CS-113 10/19/10	CS-114 10/19/10	CS-115 10/19/10	CS-116 10/19/10	CS-116 10/19/10	CS-117 10/19/10	CS-117 10/19/10
			Depth (feet)	0.5'-0.75'	1'-1.25'	1.1'-1.35'	1'-1.25'	0.5'-0.75'	0.5'-0.75'	3.75'-4'	1'-1.25'	2'-2.25'
PCB-1016	1	25		ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	1	25		ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	1	25		ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1242	1	25		ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	1	25		ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	1	25		ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	1	25		0.806	**27.2**	0.841	ND	ND	**13,700**	**441**	**150**	**40.6**

NOTES:

1. All results expressed in milligrams per kilogram.
2. ND = Not Detected at or above adjusted reporting limit.
3. Samples were analyzed utilizing EPA Method 8082.
4. **Bold values** = Concentration exceeds EPA Low Occupancy remediation objective.
5. [ ] = Concentration exceeds EPA High Occupancy remediation objective.

TABLE A

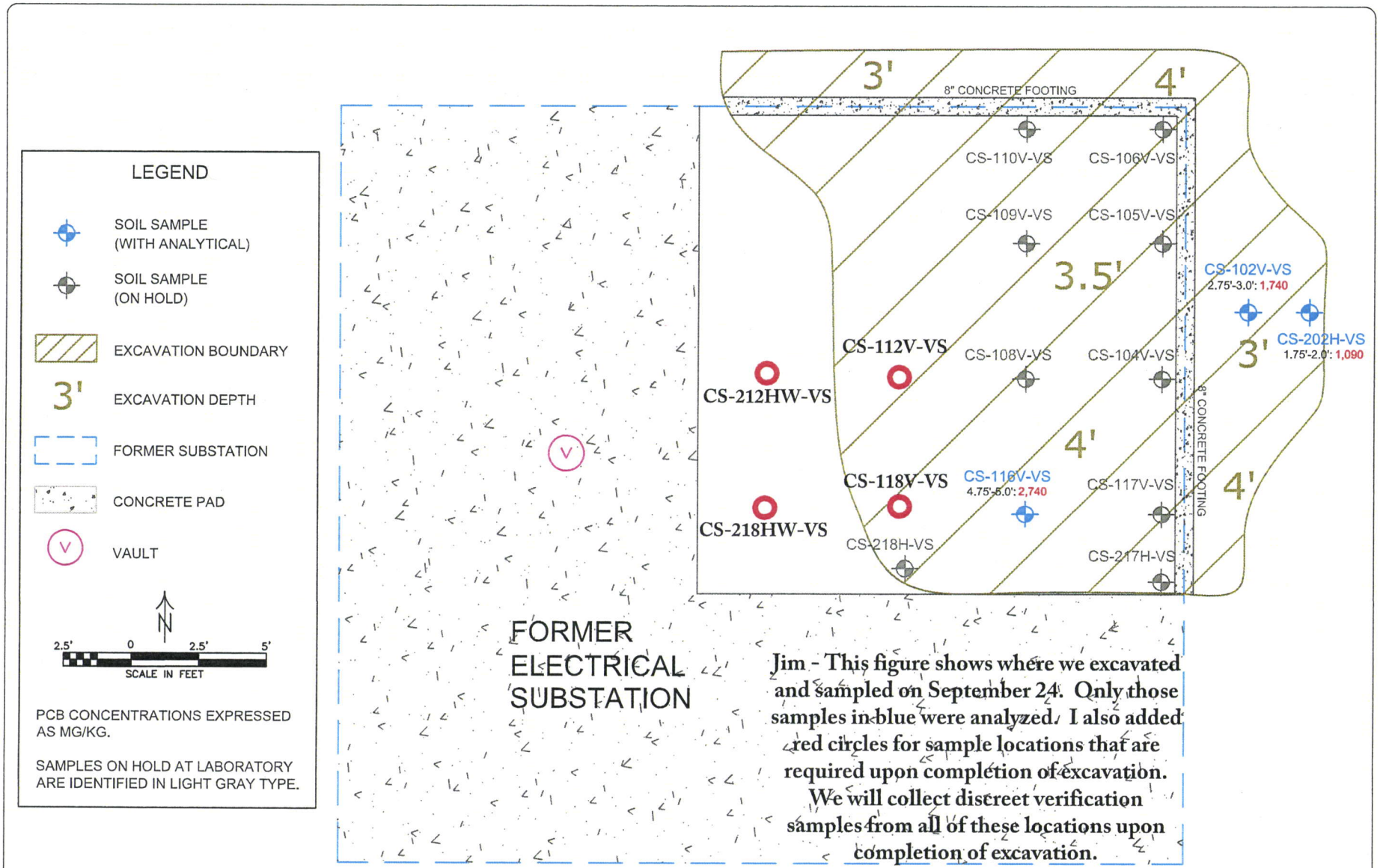
Soil Analytical Results
PCBs

Compass Big Blue - Tract F-7
8116 Wilson Road
Kansas City, Missouri

Analyte	*EPA Remediation Objectves*		Sample Date	CS-118	CS-118	CS-119
	Low Occupancy	High Occupancy	Depth (feet)	10/19/10	10/19/10	10/19/10
				1'-1.25'	2'-2.25'	0.5'-1'
PCB-1016	1	25		ND	ND	ND
PCB-1221	1	25		ND	ND	ND
PCB-1232	1	25		ND	ND	ND
PCB-1242	1	25		ND	ND	ND
PCB-1248	1	25		ND	ND	ND
PCB-1254	1	25		ND	ND	ND
PCB-1260	1	25		0.426	**22.3**	ND

NOTES:

1. All results expressed in milligrams per kilogram.
2. ND = Not Detected at or above adjusted reporting limit.
3. Samples were analyzed utilizing EPA Method 8082.
4. **Bold values** = Concentration exceeds EPA Low Occupancy remediation objective.
5. [redacted] = Concentration exceeds EPA High Occupancy remediation objective.



WCEC
ENVIRONMENTAL CONSULTANTS

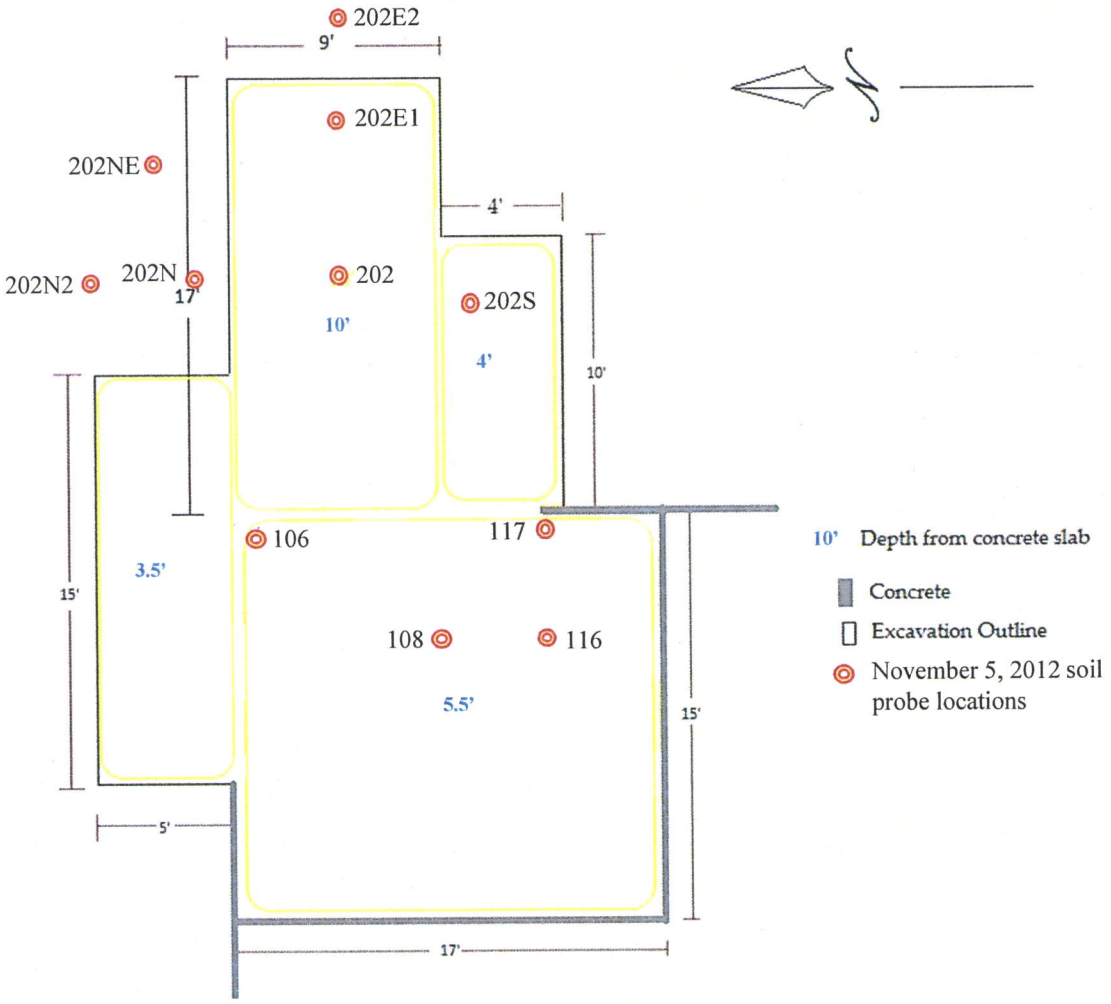
FIGURE 3

Excavation Details Map

Former GST Steel Facility
Tract F-7
Kansas City, MO

DRAWN BY: MM	PROJECT NUMBER: 12-8973-220	FILE NAME: Excavation Details.dwg	DATE: 09/28/12

10/17/12



Excavation measurements and dimensions prepared by DeNovo

SOIL PROBE LOCATIONS

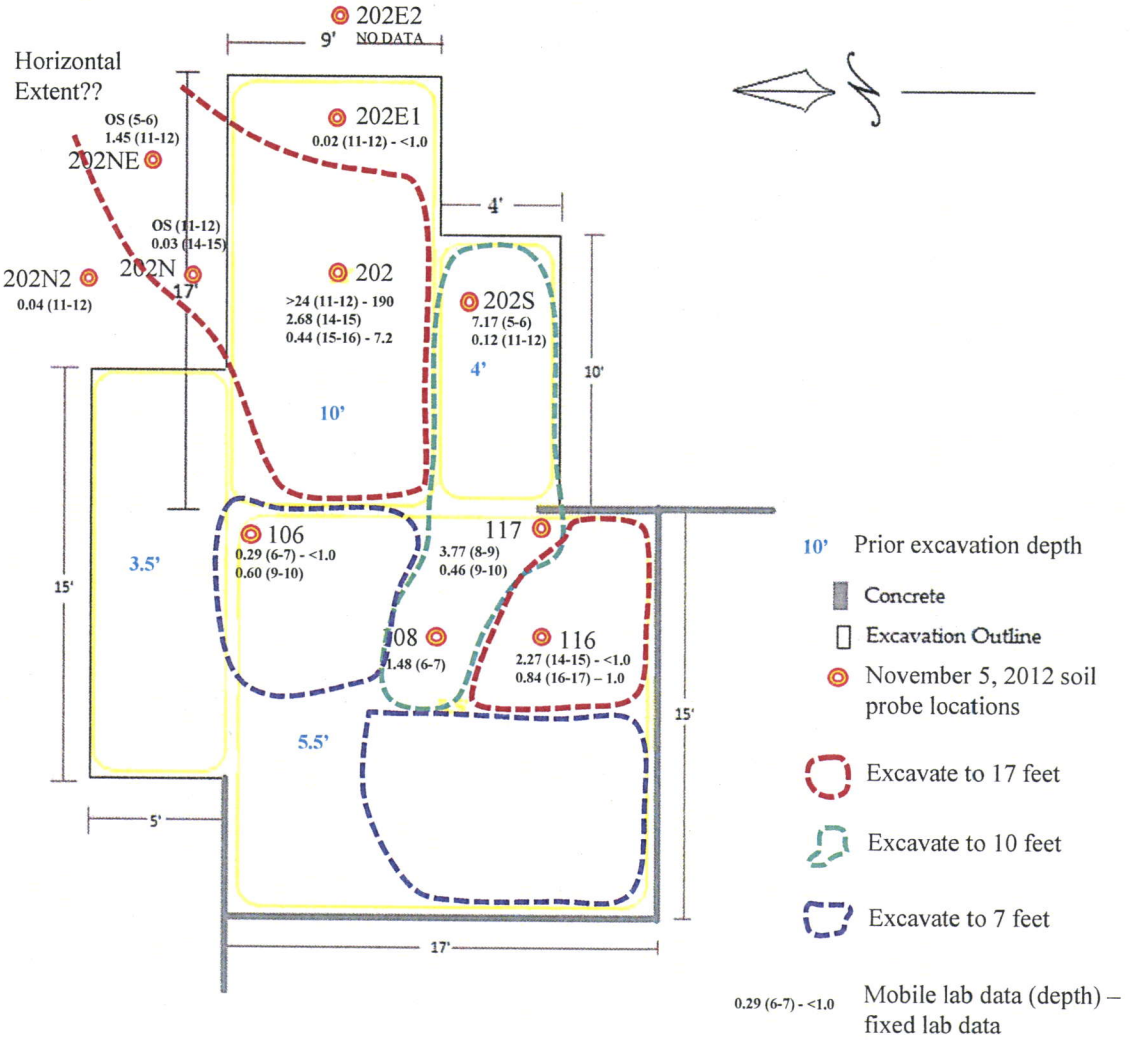
FORMER GST STEEL FACILITY
TRACT F-7
KANSAS CITY, MISSOURI

DATE: 11-05-12 | SCALE: N/A

PROJECT NO: 12-9328-220

WCEC
ENVIRONMENTAL CONSULTANTS

10/17/12



Excavation measurements and dimensions prepared by DeNovo

SOIL EXCAVATION – 1 PPM

FORMER GST STEEL FACILITY
TRACT F-7
KANSAS CITY, MISSOURI

DATE: 11-05-12 | SCALE: N/A

PROJECT NO: 12-9328-220

WCEC
ENVIRONMENTAL CONSULTANTS

Table 1
Soil Analytical Results
Soil Characterization
Former GST Facility / Tract F-7
Kansas City, Missouri

Sample ID	Sampled Depth (ft)[1]	Date Sampled	PCBs[2] Mobile Lab	PCBs[4] Fixed Lab
High Occupancy Use Cleanup Level			1	
106	**6 - 7**	11/05/12	0.29	<1.0
	9 - 10	11/05/12	0.60	NA
108	6 - 7	11/05/12	**1.48**	NA
116	14 - 15	11/05/12	**2.27**	NA
	16 - 17	11/05/12	0.84	1.0
117	8 - 9	11/05/12	**3.77**	NA
	9 - 10	11/05/12	0.46	NA
202	**11 - 12**	11/05/12	**>24**	**190**
	14 - 15	11/05/12	**2.68**	NA
	15 - 16	11/05/12	0.44	**7.2**
202N	11 - 12	11/05/12	**offscale**[3]	NA
	14 - 15	11/05/12	0.03	NA
202N2	11 - 12	11/05/12	0.04	NA
202S	5 - 6	11/05/12	**7.17**	NA
	11 - 12	11/05/12	0.12	NA
202E1	**11 - 12**	11/05/12	0.02	<1.0
202NE	5 - 6	11/05/12	**offscale**	NA
	11 - 12	11/05/12	**1.45**	NA

All concentrations expressed as mg/kg (ppm)
(1) - Depth measured from approximate elevation of concrete slab
(2) - PCBs analyzed by mobile gas chromatograph using Aroclor 1260 standard.
(3) - 'Offscale' indicates that the concentration exceeded maximum concentration of detection range
(4) - PCBs analyzed by fixed laboratory using SW-846 Method 8082A - tabulated concentrations are Aroclor 1260
NA - Not analyzed
Sample results shown in **bold** exceeded HOU Cleanup Level of 1 mg/kg
Sample depths shown in **bold** are samples that were split for fixed lab analysis